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NEW NUCLEAR VULNERABILITY DATA BASE, INPUT FORMAT, AND SUPPORTING SOFTWARE FOR RCC

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March 1980

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20. ABSTRACT *(Continue on reverse side if necessary and identify by block number)*

The BRL developed Residual Combat Capability (RCC) methodology, which includes a nuclear vulnerability data bank, was specifically designed to be easily used. The state-of-the-art technique for the description of the nuclear vulnerability of military targets involves cumulative failure distributions. The parameters which characterize these distributions are floating point numbers: constants and logarithms of means and variances. Since many such numbers are involved, handling them is difficult and error-prone. Therefore, an interactive program to interface nuclear data into RCC, with data base management capabilities,

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was developed. Through the program, the user can interactively store or manipulate nuclear vulnerability data in the standard format, and output data files in English-word, user-oriented format compatible with all other RCC inputs.

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I. INTRODUCTION TO THE PROBLEM

The Ballistic Research Laboratory has developed, from a research and development viewpoint, a combat capability evaluation methodology. Called RCC (Residual Combat Capability)[1,2], the methodology is based upon a rigorous quantification of combat capability. In developing RCC, particular attention was paid to vulnerability/lethality modeling and associated threat effectiveness factors. However, attention was also paid to the unit structure. Individual capabilities, time dependent substitutability, and alternate operating procedures were included in detail, largely with the help of the cognizant Training and Doctrine Command (TRADOC) agencies. Furthermore, a great deal of effort was spent in making the RCC code easy to use. To this end, inputs use English words and names, free field formats, and copious checks and informative diagnostics. As a result, RCC is receiving widespread attention throughout the Army as a general standard analysis tool.

The nuclear lethality module used in RCC was taken from NUDACC[3], a nuclear damage assessment code produced by the Harry Diamond Laboratory. In NUDACC, equipment items in the vicinity of a nuclear detonation may become casualties (kills) due to exposure to EMP, neutron fluence, and blast environments. Any combination of these environments may be considered for any given target. (Note: Personnel are handled separately, and are not addressed in this report.) The kill probabilities for each item are expressed as cumulative distribution functions of the appropriate environmental parameters. This information is input to the nuclear module in terms of the means and standard deviations (μ and σ) of the cumulative distributions, along with certain other constants for particular environments. The data also includes a code number, IVLARY, which indicates the combination of environments to be considered.

In constructing the original NUDACC methodology, it was anticipated that the vulnerability set would be fairly stable[4]. It was, therefore, most efficient to make the data part of the NUDACC code itself, storing

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[1] *J. Terrence Klopcic, et al, "RCC: A Methodology/Code to Model Residual Combat Capability at the Unit Level", ARBRL-TR-02156 (Apr 79)* (AD #B037451L)

[2] *J. Terrence Klopcic, et al, "RCC: A Methodology/Code to Model Residual Combat Capability at the Unit Level", ARBRL-TR-02196, Addendum to ARBRL-TR-02156 (Sep 79)* (AD #B042085L)

[3] *R.G. Moore, "Nuclear Damage Assessment Computer Code", HDL-R-210-78-4 (July 78)*

[4] *R.G. Moore, Harry Diamond Laboratory, private communication.*

it in DATA statements. Each item was given an item number, which was used to obtain indices into the densely-filled data arrays. A published list of item numbers versus item name (e.g. 101, JEEP M151) completed the interface between user and code. The current list of NUDACC items is given in Appendix A.

However, the data set has proven to be dynamic, requiring periodic updates and extensions. In particular, RCC is often used to test the sensitivity of results to possible uncertainties in the data, requiring several data changes to be made. Such changes, in the original configuration, would require recompilation of the entire program. This recompilation not only requires extra computer time, but also demands that the user have in-depth knowledge of the inner details of the nuclear module. Such effort is in contrast to the highly user-oriented nature of RCC, in which all inputs are made at run-time using English words, free formats, and "cook-book" prescriptions.

On the other hand, the nuisance and error-prone nature of handling many floating-point numbers is also appreciated. (Note that the original formulation used in the NUDACC code, avoided this problem.)

II. SOLUTION

The solution created for RCC is to maintain an off-line data base compatible with NUDACC and prescribe a standard English-worded, free field format for RCC input. These are facilitated by a utility program which supports easy updating of the data base and transfers data, in RCC format, to a file for RCC input.

1. Data Base Format

The format chosen for the data base is a large, 2-dimensional array, with rows for every potential item number (1000), and columns for more than the required number of data (20). These extra storage words allow for future additions to the data base, in terms of new items, additional kill environments for old items, or entirely new kill environments (e.g. thermal kills) for the entire array. For ease in indexing the array, storage words are allocated whether currently used or not; however, binary storage of the array results in small file size.

2. RCC Format

The input of nuclear vulnerability data to RCC was reconfigured to read an external file, unit 3. Nuclear input thus becomes parallel to the RCC input form for conventional lethality data (on unit 2). The external file approach has proven most convenient and efficient. Many runstreams may access the same data file, thus eliminating much duplication of input effort. Furthermore, the format of the data and the

highly interpretive nature of the RCC input routines makes editing of the file, using locally available processors, a very easy matter.

The format for file 3 is:

ENGLISH NAME, IVLARY, required data

where ENGLISH NAME is the user-chosen, run-time specified English name for the item (or item class), IVLARY is the code number which indicates the environments considered for the item, and the data are the corresponding constants, μs, and σs.

Appendix B contains a print-out of the instruction element included in the RCC package. This element, INPUTINFO, contains a detailed description of the format for data on file 3, as well as a description of all other input commands.

3. Supporting Code, 4TO3

The supporting code, called 4TO3, is an interactive program. Upon execution, the code asks for the required action: update the data base (on unit 4), list the data (on unit 4), or write selected data, in the RCC format (described in Appendix B), onto file 3. As a special feature, typing a dollar sign ($) causes the last line written by the code (whether on unit 3 or unit 4) to be reproduced at the user terminal. Typing $ *item numbers* causes the data for the identified items to be listed at the terminal. A complete listing of 4TO3 is contained in Appendix C.

4. Input to 4TO3

a. For Updating Data Base. The 4TO3 code, when put in the data base input mode (IN), will ask whether the data base (on file 4) is a new one being created, or an old one being changed. It then solicits data in the following format:

NUDACC Item Number, IVLARY, required data

where the NUDACC item number is discussed in section I, and the remaining data is described in section II.2. Typing END closes file 4 and returns the program to the 4TO3 executive.

b. For Making an RCC Input File (file 3). The 4TO3 code, when put in the RCC file output mode (OUT), will solicit data in the following format:

ENGLISH NAME, NUDACC Item Number

where ENGLISH NAME is described in section II.2, and NUDACC Item Number is discussed in section I. Typing END writes the word "END" on file 3 (as preferred by RCC), closes the file, and returns control to the

4T03 executive.

III. SUMMARY

The difficulty of handling strings of relatively unintelligible floating point numbers, as required for nuclear vulnerability calculations, has been largely alleviated. User-oriented, English-word-based input formats have been established for use in RCC, in consonance with all other RCC inputs. An interactive program to interface the NUDACC-compatible nuclear vulnerability data base with the RCC input files has been developed.

APPENDIX A

NUDACC Item List

	NUDACC VULNERABILITY DATA	DOSE	BLAST	TREE	EMP
001	PERSONNEL - EXPOSED	*			
002	PERSONNEL - OPEN VEHICLE	*			
003	PERSONNEL - FOX HOLE	*			
004	PERSONNEL - APC	*			
005	PERSONNEL - TANK	*			
101	TRUCK UTILITY 1/4-TON M151		*		
102	TRUCK CARGO 5/4-TON M715				
103	TRUCK CARGO 5/4-TON M715 W/S250 SHELTER		*		
104	TRUCK CARGO 1 1/4-TON GAMA GOAT M561 W/TRAILER				
105	TRUCK CARGO 2 1/2-TON M35		*		
106	TRUCK VAN SHOP 2 1/2-TON W/S280 SHELTER		*		
107	TRUCK TANK FUEL SERVICING 2 1/2-TON				
108	TRUCK VAN EXPANSIBLE 2 1/2-TON M292				
109	TRUCK VAN EXPANSIBLE 5-TON M820		*		
110	TRUCK CARGO 5-TON M656		*		
111	TRUCK TRACTOR 5-TON W/SEMITRAILER				
112	TRUCK WRECKER 5-TON M816				
113	TRUCK TANK FUEL SERVICING 2500 GAL M559				
114	TRUCK CARGO 8-TON M520		*		
115	TRUCK WRECKER 10-TON M553				
116	TRUCK 1 1/4-TON M881		*		
117	TRUCK 6X6 5-TON M814		*		
118	TRACTOR 6X6 5-TON M818		*		
119	TRACTOR 5-TON W/12-TON SEMI M818-M127A2		*		
120	TRACTOR 5-TON W/25-TON SEMI M818-M172A1		*		
201	CARRIER PERSONNEL APC M113		*		
202	CARRIER COMMAND AND RECON M114				
203	CARRIER COMMAND POST M577		*		
204	CARRIER MORTAR 4.2-IN M109		*		
205	CARRIER MORTAR 81-MM M125		*		
206	CARRIER GUIDED MISSLE TOW M113		*		
207	CARRIER CARGO M548		*		
208	COMBAT ENGINEER VEHICLE M728				
209	BRIDGE AND LAUNCHER AVLB				
210	RECOVERY VEHICLE LIGHT M578				
211	RECOVERY VEHICLE MEDIUM M88				
212	FORK LIFT RT 5-TON M488		*		
213	TRACTOR-WRECKER 5-TON M819		*		
214	SEMITRAILER 12-TON (FULL) M127A2		*		
215	SEMITRAILER 25-TON (EMPTY) M172A1		*		
299	CONCRETE IGLOO IN SASP		*		
301	RADIO VRC-12 FAMILY				*
302	RADIO VRC-46 MTD IN 1/4-TON M151		*		*
303	RADIO VRC-47 MTD IN 1/4-TON M151		*		*
304	RADIO VRC-49 MTD IN 1/4-TON M151		*		*
305	RADIO VRC-46 MTD IN 1 1/4-TON GAMA GOAT M561				*

		DOSE	BLAST	TREE	EMP
306	RADIO VRC-47 MTD IN 1 1/4-TON GAMA GOAT M561		*		
307	RADIO VRC-49 MTD IN 1 1/4-TON GAMA GOAT M561		*		
308	RADIO VRC-48 MTD IN 1/4-TON M151	*	*		
310	RADIO VRC-12 MTD IN CARRIER APC M113	*	*		
311	RADIO VRC-46 MTD IN CARRIER APC M113	*	*		
312	RADIO VRC-47 MTD IN CARRIER APC M113	*	*		
313	RADIO VRC-49 MTD IN CARRIER APC M113	*	*		
315	RADIO VRC-12 MTD IN CARRIER CMD AND RECON M114		*		
316	RADIO VRC-46 MTD IN CARRIER CMD AND RECON M114		*		
317	RADIO VRC-47 MTD IN CARRIER CMD AND RECON M114		*		
318	RADIO VRC-12 MTD IN CARRIER CMD POST M577	*	*		
319	RADIO VRC-46 MTD IN CARRIER CMD POST M577	*	*		
320	RADIO VRC-47 MTD IN CARRIER CMD POST M577	*	*		
321	RADIO VRC-49 MTD IN CARRIER CMD POST M577	*	*		
322	RADIO VRC-46 MTD IN RECOVERY VEHICLE LT M578		*		
323	RADIO VRC-46 MTD IN RECOVERY VEHICLE MED M88		*		
324	RADIO VRC-12 MTD IN ARMORED RECON VEHICLE M551		*		
325	RADIO VRC-12 MTD IN TANK M60A1		*		
331	RADIO PRC-77		*		*
332	RADIO VRC-64 MTD IN 1/4-TON	*	*		*
333	RADIO GRC-160 MTD IN 1/4-TON	*	*		*
334	RADIO VRC-64 MTD IN 1 1/4-TON GAMA GOAT M561		*		*
335	RADIO GRC-160 MTD IN 1 1/4-TON GAMA GOAT M561		*		*
336	RADIO VRC-64 MTD IN 5/4-TON M715	*	*		*
337	RADIO GRC-160 MTD IN 5/4-TON M715	*	*		*
338	RADIO VRC-64 MTD IN CARRIER APC M113	*	*		*
339	RADIO GRC-160 MTD IN CARRIER APC M113	*	*		*
340	RADIO VRC-64 MTD IN CARRIER CMD AND RECON M114		*		*
341	RADIO GRC-160 MTD IN CARRIER CMD AND RECON M114		*		*
342	RADIO VRC-64 MTD IN CARRIER CMD POST M577	*	*		*
343	RADIO GRC-160 MTD IN CARRIER CMD POST M577	*	*		*
344	RADIO GRC-160 MTD IN CARRIER MORTAR 4.2-IN M106	*	*		*
345	RADIO VRC-64 MTD IN BRIDGE AND LAUNCHER AVLB		*		*
346	RADIO VRC-64 MTD IN RECOVERY VEHICLE LT M578		*		*
347	RADIO VRC-64 MTD IN TANK M60A1		*		*
348	RADIO VRC-64 MTD IN TANK M60A2		*		*
349	RADIO VRC-64 MTD IN ARMORED RECON VEHICLE M551		*		*
350	RADIO GRC-160 MTD IN CARRIER GUIDED MISSLE TOW	*	*		*
351	RADIO TT SET GRC-142 MTD IN 1 1/4-TON GOAT M561		*		
352	RADIO TT SET GRC-142		*		
353	RADIO SET GRC-142 MTD IN 5/4-TON W/S250 SHELTER	*	*		
354	RADIO GRC-106		*		
355	RADIO GRC-106 MTD IN 1 1/4-TON GAMA GOAT M561		*		
356	RADIO GRC-106 MTD IN CARRIER APC M113	*	*		
357	RADIO GRC-106 MTD IN CARRIER CMD POST M577	*	*		
358	RADIO GRC-106 MTD IN 1/4-TON VEHICLE	*	*		

	NUDACC VULNERABILITY DATA	NOSE	BLAST	TREE	EMP
359	RADIO GRC-160 MTD IN CARRIER MORTAR 81-MM	*	*	*	
360	RADIO TRC-145 MTD ON 5/4-TON M715 W/S250 SHELTER	*	*		
361	RADIO TRC-113 MTD ON 5/4-TON M715 W/S250 SHELTER	*	*		
362	RADIO TCC-65 MTD ON 5/4-TON M715 W/S250 SHELTER	*	*		
363	RADIO GRC-103		*		
364	RADIO TTC-23 MTD ON 2 1/2-TON W/S280 SHELTER	*			
365	RADIO TTC-29 MTD ON 5/4-TON M715 W/S250 SHELTER	*			
366	TELETYPE VSC-3 MTD IN CARRIER CMD POST M577	*	*		
367	MULTIPLEXER TD-660		*		
368	MULTIPLEXER CABLE COMBINER TD-204/754		*		
369	CONVERTER CV-1548		*		
371	RADIO VRC-64 MTD IN CARRIER MORTAR 4.2-IN M106	*	*	*	
372	RADIO VRC-64 MTD IN RECOVERY VEHICLE MED M88		*	*	
373	RADIO VRC-64 MTD IN CARRIER GM TOW M113	*	*	*	
374	RADIO GRC-160 MTD IN CARRIER GM TOW M113	*	*	*	
375	RADIO VRC-46 MTD IN 5/4-TON M715		*		
376	RADIO VRC-47 MTD IN 5/4-TON M715		*		
377	RADIO VRC-49 MTD IN 5/4-TON M715		*		
378	RADIO GRC-106 MTD IN 5/4-TON M715		*		
379	RADIO GRC-160 MTD IN RECOVERY VEHICLE LT M578		*	*	
380	PATCH CNTR TSC-76 MTD IN 5/4-TON W/S250 SHELTER	*			
381	MSG CNTR GSQ-80 MTD ON 2 1/2-TON W/S280 SHELTER	*			
382	TGRAPH TML TSC-58 ON 2 1/2-TON W/S280 SHELTER	*			
383	TELETYPWRITER SET TT-4/TG				
384	TELETYPWRITER SET AN/FGC-25				
385	OPS CTR CMD AN/MSC-31 ON 2 1/2-TON W/S280	*			
386	TEL CNTRL OFF AN/TCC-29 ON 1 1/4-TON M561				
387	TEL TML AN/TCC-29 ON 1 1/4-TON GAMA GOAT W/S250				
388	RADIO TT SET AN/UGC-74 ON 1 1/4-TON GAMA GOAT				
389	RADIO TT SET AN/UGC-75 ON 1 1/4-TON GAMA GOAT				
390	RADIO VRC-44 MTD IN 1/4-TON M151	*	*		
391	RADIO VFC-44 MTD IN CARRIER APC M113	*	*		
401	DIVISION ARTILLERY COMPUTER (TACFIRE)	*	*		
402	BATTALION COMPUTER (TACFIRE)	*	*		
403	VARIABLE FORMAT MESSAGE ENTRY DEVICE (VFMED)		*		
404	BATTERY DISPLAY UNIT (BDU)		*		
405	DIGITAL MESSAGE DEVICE (DMD)		*		
406	BATTERY COMPUTER SYSTEM (BCS)		*		
501	AN/TVS-4 NIGHT SIGHT				
502	PPS-5 RADAR SET		*		
503	PPS-15 RADAR SET				
504	MPQ-49 FWD AREA ALTERING RADAR				
505	GVS-3 RANGE FINDER-LASER				
506	AN/MPQ-4 RADAR SET COUNTER MORTAR				
508	TPS-25 RADAR SET				
601	TOW				

602	DRAGON		
603	REDEYE		
604	LANCE	*	*
605	TRACKER DRAGON		
701	PU 617/M 3KW TMD	*	
702	PU 618/M 5KW TMD		
703	PU 619/M 10KW TMD		
704	PU 564A/G 10KW TMD		
705	PU 620/M 5KW TMD		
706	PU 628 3KW TMD		
707	PU 625/G 3KW TMD		
801	HOWITZER 155MM SP M109A1	*	
802	HOWITZER 155MM TOWED M114		
803	HOWITZER 8-IN SP M110	*	
804	TANK COMBAT M60A1		
805	TANK COMBAT M60A2		
901	HELICOPTER OBSERVATION OH-58		
902	HELICOPTER UTILITY UH-1		
903	HELICOPTER ATTACK AH-1G		

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APPENDIX B

RCC Input Info

AMUCK*VALRCC.INPUTINFO

INPUT FOR RCC

GENERAL COMMENTS

RCC INPUTS ARE ALL MNEMONIC AND FREE-FIELD (AND MACHINE INDEPENDENT, ALMOST). THREE FORMS OF INPUT ARE SOLICITED: ALL HOLLERITH, ONE HOLLERITH NAME (TWO WORDS) FOLLOWED BY NUMBERS (FIXED AND F.P., MIXED), AND ALL NUMBERS. HOLLERITH STRINGS ARE SEPARARTED BY COMMAS. NUMBERS BY COMMAS OR SPACES. LEADING BLANKS ARE IGNORED.

THE GENERAL FORM OF A RUNSTREAM IS AS FOLLOWS:

REPERTOIRE: ALL NAMES TO BE USED FOR FUNCTIONAL GROUPS AND WEAPONS
END
ENCOUNTER1 INPUTS: ALL OTHER DATA, INCLUDING PROGRAM CONTROLS, FOR THE ENCOUNTER. STANDARD FORM IS:
    MNEMONIC - TO INDICATE TYPE OF DATA
    DATA
    END
(NOTE, HOWEVER, THAT RCC TRIES VERY HARD TO COMPENSATE FOR MISSING END CARDS. AT PRESENT, ONLY THE END CARD AFTER THE REPERTOIRE IS ESSENTIAL)
AFTER THE DATA IS IN:
GO THE PROGRAM EXECUTES ONE ENCOUNTER AND RETURNS FOR NEW ENCOUNTER INPUTS
STOP ENDS PROGRAM

SPECIAL FEATURE: A CARD BEGINNING WITH A DOLLAR SIGN, $, IS INTERPRETED AS A CONTINUATION CARD, IF POSSIBLE. IF NOT, IT IS REINTERPRETED AS A COMMENT CARD. HENCE, FOR EXAMPLE, COMMENTS CAN BE INSERTED IN THE RUNSTREAM AFTER ANY END CARD.

** ANY ITEM IN SQUARE BRACKETS [ ] IS NOT ESSENTIAL TO THE INPUT FORMAT, BUT CONVEYS ADDED INFORMATION. NESTED BRACKETS INDICATE OPTIONS W/IN OPTIONS. PARENTHESES ( ) ENCLOSE COMMENTS FOR THIS LISTING **

REPERTOIRE INPUT

FORMAT

```
WEAPON
WEAPON NAME1 [, ALT. NAME, ALT. NAME, .... ]
WEAPON NAME2 [, ALT. NAME, ALT. NAME, .... ]
WEAPON NAME3 [, ALT. NAME, ALT. NAME, .... ]
.............
FUNCTIONAL GROUP   ( OR FG OR FGS )
FUNCTIONAL GROUP NAME1 [, ALT. NAME, ALT. NAME, .... ]
FUNCTIONAL GROUP NAME2 [, ALT. NAME, ALT. NAME, .... ]
FUNCTIONAL GROUP NAME3 [, ALT. NAME, ALT. NAME, .... ]
 .........
END
```

COMMENTS ON REPERTOIRE INPUT

1. SOME NAMES MAY BE COMMON TO SEVERAL FG S OR WEAPONS. THIS ALLOWS SUBSCRIBING A COMMON CHARACTERISTIC TO SEVERAL ITEMS BY ATTACHING THE CHARACTERISTIC TO THE COMMON NAME.
2. FG OR WEAPON NAMES MAY BE INPUT IN ANY ORDER, OR MIXED, AS LONG AS AN FG OR WEAPON CARD PRECEDES THE NAMES.
3. FOR SECONDARY EXPLOSION, COLOCATE EXPOSIVE WITH TARGET. EXPLOSIVE MUST APPEAR IN BOTH TARGET AND WEAPON REPERTOIRE LISTS.

ENCOUNTER INPUTS
****

FORMAT
......

NOTE: TIMES ARE IDENTIFIES AS ENCOUNTER TIME (CLOCK) OR TIME INTERVALS (INTRVL) - USED TO INPUT A PERIOD OF TIME AFTER AN EVENT

MNEMONIC	SUBSEQUENT DATA CARDS
	UNIT INPUTS
CHAINS	LINKS - HOLLERITH STRINGS IN EACH CHAIN LINKS MUST BE DEFINED PRIOR TO USE IN 'CHAINS' INPUT. SEE LINKS BELOW 'CLEAR' WILL CLEAR ALL PREVIOUS CHAINS
COMPOUND LINK	$COMPOUND LINK NAME LINK, (REAL) MAXIMUM CONTRIBUTION OF THIS LINK LINK, (REAL) MAXIMUM CONTRIBUTION OF THIS LINK .....
DEPLOY	FG,X,Y OF TARGET POINT, [-] NO. THERE, CONV. KILL CRITERION, NUCLEAR K.C., POSTURE CODE, NUC COVER CODE (NEGATIVE NO. THERE INDICATES A DUMMY TARGET) FOR SECONDARY EXPLOSIVE SOURCE, PUT KILL CRITERIA (BOTH CONV. AND NUCL.) = 0. (UNDERSTOOD IN LETHALITY (UNIT 2.) THAT ONE CRIT. (EXPLODE) PERTAINS)
DUCK	FG,TIME(INTRVL) TO DUCK,FROM CONV. POSTR,FROM NUCVR,TO CONV. POSTR,TO NUCVR
EXTERNAL RECONSTITUTION	FG REINFORCING, TIME(CLOCK) OF ARRIVAL, NUMBER OF THEM
FATIGUE	LINK NAME, TIME, NEW CAP100%, CAP0%, MAXEFF%
	(SEE LINKS, BELOW)
LINKS	LINK NAME(=NAME OF HOMELINK FG), (REAL) NO. OF FG FOR 100% CAP., 0 % CAP.[,MAX. EFF.] (IF 1 INTEGER, TAKEN AS REMAINING CAP. AT 0. SURV.) (IF NO MAX. EFFECTIVENESS, MAX EFF = 1.) [$,FGSUB1,FGSUB2,.... (SUBSTITUTES)] [[$,] ST1,ST2,.... (SUBSTITUTION TIMES(INTRVL))] (EACH SUBSTITUTE CARD MUST BE FOLLOWED BY A SUBST. TIMES CARD) 'CLEAR' WILL CLEAR ALL PREVIOUS LINKS
SIGNIFICANCE	FRACTIONAL AMOUNT OF IMPROVEMENT NEEDED BEFORE COMMANDER WILL VIOLATE PRIORITY IN SUBSTITUTION
	WEAPON INPUTS
DELIVERY ERROR	WEAPON NAME, [TIME(CLOCK),] RANGE ERRORS - INDEP., CORR., DEFLECTION ERRORS - INDEP., CORR., HOB ERROR ** NOTE: IN RCC, ALL ERRORS ARE INPUT AS SINGLE AXIS STANDARD DEVIATIONS (= SQRT(VARIANCE, 1-AXIS)) ** ** NOTE: IF TIME IS PRESENT, INPUT IS AN EVENT (CHANGE IN VALUE DURING ENCOUNTER). ELSE = INITIAL VALUE
ROUND	WEAPON NAME, TIME(CLOCK), DGZ X, Y, Z
TLE	[TIME(CLOCK),] ERRORX AND ERRORY SEE NOTE ON ERROR FORM, ABOVE
VOLLEY	WPN NAME, TIME(CLOCK), PATTERN MIDPT - X, Y, Z, NO. RNDS, DIRECTION OF PATTERN - DEG., LENGTH OF PATTERN [$, TOTAL DURATION, TIME(INTRVL) BETWEEN VOLLEYS, DIRECTION OF MOVE OF MIDPT., DISTANCE OF MOVE] (THIS ALLOWS INPUT OF A MOVING BARRAGE) NOTE: DIRECTION ANGLE IS MEASURED CCW FROM +X (FRONT TO REAR)
	LETHALITY INPUTS

```
CONVENTIONAL              NO DATA FOLLOWS IN RUNSTREAM - DATA READ FROM UNIT 2 ( SEE CONVENTIONAL DATA, BELOW )
CUMULATIVE DOSE           FG, CUMULATIVE DOSE FOR CASUALTY
                          OPTIONS: ALL, LEVEL ( SETS ALL FGS TO SAME DOSE LEVEL )
                                   NONE  ( TURNS OFF CUMULATIVE DOSE KILLS )
                          DEFAULT IS LOWEST DOSE LEVEL OF ANY LINK IN WHICH EACH FG CAN SERVE
LD50                      DESCRIPTION ( <= 12 CHARACTER HOLLERITH STRING ), KILL CRITERION ( 1-5 ), LD50
NUCLEAR                   NO DATA FOLLOWS IN RUNSTREAM - DATA READ FROM UNIT 3 ( SEE NUCLEAR DATA, BELOW )
SHIELDING                 DESCRIPTION ( <= 12 CHARACTER HOLLERITH STRING ), USER-CHOSEN CODE INTEGER, TRANSMISSION FACTOR
YIELD                     WEAPON NAME, YIELD ( KT - USED IN NUC ONLY )


                          CONTROL INPUTS
                          ..............

GO                        NO DATA FOLLOWS - CAUSES ENCOUNTER EXECUTION
HEADING                   READ ONE HOLLERITH STRING - ENCOUNTER OUTPUT HEADING
INPUT                     OPTION, 'ON' OR 'OFF'
                          OPTIONS: DEBUG ( PROCESS INPUT, BUT DO NOT EXECUTE )
INTERNAL RECONS. TIME     TIMES(INTRVL) AFTER ARRIVAL OF  RND AT WHICH RECONSTITUTION IS TO BE EVALUATED ( .LE. 11 INTRVLS )
                                RECONSTITUION SURPRESSED IF ANOTHER RND ARRIVES IN THE MEANTIME
OUTPUT OPTIONS            OPTION, 'ON' OR 'OFF'
                          OPTIONS: (OUTPUT AFTER EACH:) ITERATION, RECONSTITUTION, WEAPON DELIVERY, CASUALTIES,
                                   PRINT7 ( PRINT ON ALT. PRNT. FILE 7 )
                                   DOSE  (NUCLEAR), LETHALITY (LISTING OF TAPE 2 AT END OF RUN), DEPLOYMENT PLOT ( DEFAULT=ON )
                                   SUMMARY, NAME1, NAME2 / OR SUMMARY, OFF ( SUM OF SURVIVORS HAVING SAME NAME ( MAX 13 ) )
                                   LINK SUMMARY, LINK1, LINK2 / OR LINK SUMMARY, OFF ( NO. TIMES WEAKEST BY CHAIN ( MAX 12 ) )
RANDOM NUMBER SEED        INTEGER R.N. SEED FOR ENCOUNTER - ALLOWS RUNNING NEW ENCOUNTER W/ SAME R.N.S
REPLICATIONS              NO. OF REPLICATIONS PER ENCOUNTER
STOP                        END OF RUN. NO INPUT FOLLOWS
SUBSEQUENT MISSION        NO DATA FOLLOWS THIS CARD - AFTER ENCOUNTER, SURVIVORS ARE SAVED.
                          AFTER 'GO' CARD, NEW LINKS, CHAINS, HEADINGS CAN BE INPUT FOR OPTIMIZATION
                          END SUCH INPUT WITH ANOTHER 'GO'. SUBSEQUENT MISSIONS CAN BE LINKED


                          CONVENTIONAL LETHALITY DATA ( UNIT 2 )
                          **************************************

WEAPON
WEAPON PARAMETERS ( FROM SANDMEYER, AMSAA )
                          CARD 1: 8 (REAL) VALUES
                          CARD 2: 4 (REAL) VALUES
                          CARD 3: A6, I6  ( IF A6 .NE. 3HICM, I6 IS MEANINGLESS AND DO NOT READ CARDS 4 AND 5 )
                          CARD 4: 5 ( REAL ) ICM VALUES
                          CARD 5: 10 ( REAL ) ICM VALUES
TARGET, DATA TYPE : 2 = CARLETON FUNCTION, 3 = 1-CONTOUR COOKIE CUTTER, 4 = ICM, 5 = 2-CONTOUR COOKIE
                  : 6 = 3-COOKIE, 7 = FRONT/BACK ASYMETRIC CARLTON
                  : 8 = ASYM. 1-COOKIE , 9 = ASYM. 2-COOKIE, 1- = ASYM. 3-COOKIE
                  : ( ASYM. FORMAT: RX FOR TRGT X > BURST, RY, RX FOR TRGT X < BURST )
NHOB, NOMINAL HOB VALUE FOR WHICH EACH LETHALITY APPLIES
     ( RCC CONSTRUCTS RANGES ABOUT EACH HOB TO INTERPOLATE FOR ANY HOB )
NPOSTURES, DESCRIPTIONS
NKILLCRITERIA, DESCRIPTIONS
     ..........................................
     ..NHOB*NPOSTURES*NKILLCRITERIA DATA CARDS...
     ...EACH DATA CARD CONTAINS:...
                          DATA TYPE 2: 3 ( REAL ) VALUES
```

```
                        DATA TYPE 3: 3 ( REAL ) VALUES - PK, RX, RY
                        DATA TYPE 4: 1 ( REAL ) VALUES
                        DATA TYPE 5: 6 ( REAL ) VALUES
                        DATA TYPE 6: 9 ( REAL ) VALUES
                        DATA TYPE 7: 4 ( REAL ) VALUES
                        DATA TYPE 8: 4 ( REAL ) VALUES - PK, RX, RY, RXP
                        DATA TYPE 9: 8 ( REAL ) VALUES
                        DATA TYPE 10: 12 ( REAL ) VALUES
     ..........................................

 LOOP BACK FOR NEW TARGET
END - LOOP BACK FOR NEW WEAPON
END - EXIT BACK TO MAIN ROUTINE


                        NUCLEAR VULNERABILITY DATA ( UNIT 3 )
                        *************************************

TARGET ( FG ), CODE, DATA ( AS REQUIRED BY CODE )
                        CODES:  1 = EMP, 2 = TREE, 3 = EMP+TREE, 4 = BLAST, 5 = 1+4, 6 = 2+4, 7 = 1+2+4
                        DATA: AS SPECIFIED BY NUDACC
                              EMP: MU AND SIGMA
                              TREE: T2, MU, AND SIGMA
                              BLAST: K, MU, AND SIGMA
                        ORDER: AS NEEDED, EMP, THEN TREE, THEN BLAST

                        *** AUXILIARY PROGRAM RCCFILE.4TO3 ***
     MAINTAINS DATA BASE UNIT 4 ( NUDACCDATA )
     MAKES FILE 3 IN PROPER FORMAT FOR RCC RUNS
     RUN RCCFILE.4TO3. INSTRUCTIONS APPEAR INTERACTIVELY
```

APPENDIX C

4TO3 Listings

```
AMUCK*RCCFILE(1).4TO3
      C     THIS PROGRAM STORES DATA ON FILE 4 AND MAKES UP FILE 3 FOR RCC
      C     PRINT OPTION IS ALSO PROVIDED
            DIMENSION DATA(1000,20)
            DIMENSION IVLARY(1000,20)
            EQUIVALENCE ( IVLARY,DATA )
            COMMON/CARD/ NAME(2), NR, RR(17), NI, INT(20)
            DIMENSION IFORM(2), NAMHLD(2)
            DATA IFORM /6H@BRKPT, 6H 7      /
            DATA IN, IOUT, ILIS / 3HIN , 3HOUT, 3HLIS /
            DATA NEW, IOLD, IEND / 3HNEW, 3HOLD, 3HEND /
            CALL MACSET
       10   WRITE(6,19)
       19   FORMAT(' TYPE OUT FOR OUTPUT ( FILE 3 ), IN FOR INPUT ',
           + '(FILE 4)',/' TYPE LIS FOR TOTAL LISTING OF 4 , OR END TO STOP')
            READ(5,29) IWD
       29   FORMAT( A3 )
            IF( IWD .EQ. IEND )  GO TO 9000
            IF( IWD .EQ. IN )  GO TO 5000
            IF( IWD .EQ. ILIS )  GO TO 3000
            IF( IWD .NE. IOUT )  GO TO 10
            REWIND 4
            REWIND 3
            READ(4) DATA
       90   WRITE(6,129)
       129  FORMAT(' TYPE NAME, NUDACC CODE NO.... TO STOP, TYPE END')
            WRITE(6,919)
       919  FORMAT(' TYPE $ FOR LOOK AT LAST PROGRAM-WRITTEN LINE ',/
           $ ' TYPE $ ITEM NUMBERS FOR DATA ON SPECIFIC ITEMS' )
       100  CALL READ1(5,$1500,$2000,$2000)
            NAMHLD(1) = NAME(1)
            NAMHLD(2) = NAME(2)
            IF( NI .EQ. 1 .AND. NR .EQ. 0 )  GO TO 110
       103  WRITE(6,109)
       109  FORMAT(' INPUT ERROR' )
            GO TO 90
       110  NDX = INT(1)
            IF( IVLARY(NDX,1) .GE. 0 )  GO TO 120
            WRITE(6,119) NDX
       119  FORMAT(' NO DATA FOR ITEM W/ NUDACC NUMBER ', I6 )
            GO TO 100
       120  CONTINUE
            NDD = IVLARY(NDX,1)+1
            GO TO (1990,1001,1002,1003,1004,1005,1006,1007), NDD
       1001 CONTINUE
      C     EMP ONLY
            WRITE(3,1109) NAME, IVLARY(NDX,1), ( DATA(NDX,L), L=2,3 )
       1109 FORMAT( 2A6,',', I2,',' 15(1X,F6.2) )
            GO TO 100
       1002 CONTINUE
      C     TREE ONLY
            WRITE(3,1109) NAME, IVLARY(NDX,1), ( DATA(NDX,L), L=4,6 )
            GO TO 100
       1003 CONTINUE
      C     EMP AND TREE
            WRITE(3,1109) NAME, IVLARY(NDX,1), ( DATA(NDX,L), L=2,6 )
            GO TO 100
```

```
 1004 CONTINUE
C      BLAST ONLY
       WRITE(3,1109) NAME, IVLARY(NDX,1), ( DATA(NDX,L), L=7,9 )
       GO TO 100
 1005 CONTINUE
C      EMP AND BLAST
       WRITE(3,1109) NAME, IVLARY(NDX,1), ( DATA(NDX,L), L=2,3 ),
      + ( DATA(NDX,L), L = 7,9 )
       GO TO 100
 1006 CONTINUE
C      TREE AND BLAST
       WRITE(3,1109) NAME, IVLARY(NDX,1), ( DATA(NDX,L), L=4,9 )
       GO TO 100
 1007 CONTINUE
C      EMP, TREE, AND BLAST
       WRITE(3,1109) NAME, IVLARY(NDX,1), ( DATA(NDX,L), L=2,9 )
       GO TO 100
 1990 CONTINUE
C      PERSONNEL
       WRITE(3,1999) NAME, IVLARY(NDX,1)
 1999 FORMAT( 2A6, ',', I4 )
       GO TO 100
 1500 CONTINUE
C      IF HERE, SAW $
       IF( NI .EQ. 0 .AND. NR .EQ. 0 )  GO TO 1550
       IF( NI .LT. 1 .OR. NR .NE. 0 )  GO TO 103
C      IF HERE, WANT DATA FROM ITEMS
       NBACK = 1
       GO TO 7000
 1550 CONTINUE
C      IF HERE, WANT TERMINAL PRINT OF LAST OUTPUT
       GO TO (1790,1601,1602,1603,1604,1605,1606,1607), NDD
 1601 CONTINUE
C      EMP ONLY
       WRITE(6,1609) NAMHLD, IVLARY(NDX,1), ( DATA(NDX,L), L=2,3 )
 1609 FORMAT( 1X, 2A6,',', I2,',' 15(1X,F6.2) )
       GO TO 100
 1602 CONTINUE
C      TREE ONLY
       WRITE(6,1609) NAMHLD, IVLARY(NDX,1), ( DATA(NDX,L), L=4,6 )
       GO TO 100
 1603 CONTINUE
C      EMP AND TREE
       WRITE(6,1609) NAMHLD, IVLARY(NDX,1), ( DATA(NDX,L), L=2,6 )
       GO TO 100
 1604 CONTINUE
C      BLAST ONLY
       WRITE(6,1609) NAMHLD, IVLARY(NDX,1), ( DATA(NDX,L), L=7,9 )
       GO TO 100
 1605 CONTINUE
C      EMP AND BLAST
       WRITE(6,1609) NAMHLD, IVLARY(NDX,1), ( DATA(NDX,L), L=2,3 ),
      + ( DATA(NDX,L), L = 7,9 )
       GO TO 100
 1606 CONTINUE
C      TREE AND BLAST
       WRITE(6,1609) NAMHLD, IVLARY(NDX,1), ( DATA(NDX,L), L=4,9 )
```

```
114             GO TO 100
115          1607 CONTINUE
116           C     EMP, TREE, AND BLAST
117             WRITE(6,1609) NAMHLD, IVLARY(NDX,1), ( DATA(NDX,L), L=2,9 )
118             GO TO 100
119          1790 CONTINUE
120           C     PERSONNEL
121             WRITE(6,1799) NAMHLD, IVLARY(NDX,1)
122          1799 FORMAT( 1X, 2A6, ',', I4 )
123             GO TO 100
124          2000 CONTINUE
125             WRITE(3,29) IEND
126             ENDFILE 3
127             GO TO 10
128          3000 REWIND 4
129             READ(4) DATA
130             WRITE(6,2989)
131          2989 FORMAT(' TO WRITE ON FILE 7, TYPE 7.  ELSE 6 ' )
132             IM6 = 6
133             READ(5,2979) IX
134          2979 FORMAT( I1 )
135             IF( IX .EQ. 7 )  IM6 = 7
136             WRITE(IM6,2999)
137          2999 FORMAT('1PRINT-OUT OF DATA FROM FILE 4',/,1X,29('*'),//
138                + ' NUDACC',/,' NUMBER  IVLARY       DATA',/,1X, 29('-'),/)
139             DO 3100  I = 1, 1000
140             IF( IVLARY(I,1) .LT. 0 )  GO TO 3100
141             NDD = IVLARY(I,1)+1
142             GO TO (3990,3001,3002,3003,3004,3005,3006,3007), NDD
143          3001 CONTINUE
144           C     EMP ONLY
145             WRITE(IM6,3109) I, IVLARY(I,1), ( DATA(I,L), L=2,3 )
146          3109 FORMAT( I7, I7, 3X, 15F7.2 )
147             GO TO 3100
148          3002 CONTINUE
149           C     TREE ONLY
150             WRITE(IM6,3109) I, IVLARY(I,1), ( DATA(I,L), L=4,6 )
151             GO TO 3100
152          3003 CONTINUE
153           C     EMP AND TREE
154             WRITE(IM6,3109) I, IVLARY(I,1), ( DATA(I,L), L=2,6 )
155             GO TO 3100
156          3004 CONTINUE
157           C     BLAST ONLY
158             WRITE(IM6,3109) I, IVLARY(I,1), ( DATA(I,L), L=7,9 )
159             GO TO 3100
160          3005 CONTINUE
161           C     EMP AND BLAST
162             WRITE(IM6,3109) I, IVLARY(I,1), ( DATA(I,L), L=2,3 ),
163                + ( DATA(I,L), L = 7,9 )
164             GO TO 3100
165          3006 CONTINUE
166           C     TREE AND BLAST
167             WRITE(IM6,3109) I, IVLARY(I,1), ( DATA(I,L), L=4,9 )
168             GO TO 3100
169          3007 CONTINUE
170           C     EMP, TREE, AND BLAST
```

```
171             WRITE(IM6,3109) I, IVLARY(I,1), ( DATA(I,L), L=2,9 )
172             GO TO 3100
173          3990 CONTINUE
174           C     PERSONNEL
175             WRITE(IM6,3999) I, IVLARY(I,1)
176          3999 FORMAT( 2I7 )
177          3100 CONTINUE
178             IF( IM6 .EQ. 7 )  CALL ERTRAN(6,IFORM)
179           C     THE PRECEEDING CLOSES A UNIVAC BRKPT FILE. THIS IS MACHINE DEPENDENT
180             GO TO 10
181          5000 CONTINUE
182           C     THIS SECTION MAKES FILE 4
183             REWIND 4
184          5005 WRITE(6,5009)
185          5009 FORMAT(' FOR NEW FILE, TYPE NEW. ELSE, OLD . TO STOP, END' )
186             READ(5,29)  IWD
187             IF( IWD .EQ. NEW )  GO TO 5010
188             IF( IWD .NE. IOLD )  GO TO 5005
189             READ(4) DATA
190             GO TO 5020
191          5010 DO 5015  I = 1, 1000
192          5015 IVLARY(I,1) = -1
193          5020 CONTINUE
194             WRITE(6,5019)
195          5019 FORMAT(' ENTER NUDACC NO., CODE ( IVLARY ), APPROPRIATE DATA')
196             WRITE(6,919)
197          5022 CONTINUE
198             CALL READ0(5,$5500,$6000,$6000)
199             IF( NI .EQ. 2 )  GO TO 5030
200          5025 WRITE(6,5029)
201          5029 FORMAT(' INPUT ERROR' )
202             GO TO 5020
203          5030 NDX1 = INT(1)
204             NDX2 = INT(2)+2
205             GO TO ( 5990,5990,5101,5102,5103,5104,5105,5106,5107 ), NDX2
206          5101 CONTINUE
207           C     EMP ONLY
208             IF( NR .NE. 2 )  GO TO 5025
209             IVLARY(NDX1,1) = INT(2)
210             DATA(NDX1,2) = RR(1)
211             DATA(NDX1,3) = RR(2)
212             GO TO 5022
213          5102 CONTINUE
214           C     TREE ONLY
215             IF( NR .NE. 3 )  GO TO 5025
216             IVLARY(NDX1,1) = INT(2)
217             DATA(NDX1,4) = RR(1)
218             DATA(NDX1,5) = RR(2)
219             DATA(NDX1,6) = RR(3)
220             GO TO 5022
221          5103 CONTINUE
222           C     EMP AND TREE
223             IF( NR .NE. 5 )  GO TO 5025
224             IVLARY(NDX1,1) = INT(2)
225             DATA(NDX1,2) = RR(1)
226             DATA(NDX1,3) = RR(2)
227             DATA(NDX1,4) = RR(3)
```

```
228             DATA(NDX1,5) = RR(4)
229             DATA(NDX1,6) = RR(5)
230             GO TO 5022
231          5104 CONTINUE
232          C     TREE ONLY
233             IF( NR .NE. 3 )  GO TO 5025
234             IVLARY(NDX1,1) = INT(2)
235             DATA(NDX1,7) = RR(1)
236             DATA(NDX1,8) = RR(2)
237             DATA(NDX1,9) = RR(3)
238             GO TO 5022
239          5105 CONTINUE
240          C     EMP AND BLAST
241             IF( NR .NE. 5 )  GO TO 5025
242             IVLARY(NDX1,1) = INT(2)
243             DATA(NDX1,2) = RR(1)
244             DATA(NDX1,3) = RR(2)
245             DATA(NDX1,7) = RR(3)
246             DATA(NDX1,8) = RR(4)
247             DATA(NDX1,9) = RR(5)
248             GO TO 5022
249          5106 CONTINUE
250          C     TREE AND BLAST
251             IF( NR .NE. 6 )  GO TO 5025
252             IVLARY(NDX1,1) = INT(2)
253             DATA(NDX1,4) = RR(1)
254             DATA(NDX1,5) = RR(2)
255             DATA(NDX1,6) = RR(3)
256             DATA(NDX1,7) = RR(4)
257             DATA(NDX1,8) = RR(5)
258             DATA(NDX1,9) = RR(6)
259             GO TO 5022
260          5107 CONTINUE
261          C     EMP, TREE, AND BLAST
262             IF( NR .NE. 8 )  GO TO 5025
263             IVLARY(NDX1,1) = INT(2)
264             DATA(NDX1,2) = RR(1)
265             DATA(NDX1,3) = RR(2)
266             DATA(NDX1,4) = RR(3)
267             DATA(NDX1,5) = RR(4)
268             DATA(NDX1,6) = RR(5)
269             DATA(NDX1,7) = RR(6)
270             DATA(NDX1,8) = RR(7)
271             DATA(NDX1,9) = RR(8)
272             GO TO 5022
273          5990 CONTINUE
274          C     PERSONNEL OR ERASE ( -1 )
275             IVLARY(NDX1,1) = INT(2)
276             DO 5992  L = 2,9
277          5992 DATA(NDX1,L) = 0.
278             GO TO 5022
279          5500 CONTINUE
280          C     IF HERE, SAW $
281             IF( NI .EQ. 0 .AND. NR .EQ. 0 )  GO TO 5520
282             IF( NI .LT. 1 .OR. NR .NE. 0 )  GO TO 5025
283          C     IF HERE, WANT DATA FROM ITEMS
284             NBACK = 2
```

```
285             GO TO 7000
286          5520 CONTINUE
287           C     IF HERE, WANT LAST ITEM
288             NBACK = 2
289             NI = 1
290             INT(1) = NDX1
291             GO TO 7000
292          6000 CONTINUE
293           C     WRITE NEW FILE 4
294             REWIND 4
295             WRITE(4) DATA
296             ENDFILE 4
297             GO TO 10
298          7000 CONTINUE
299             DO 7100  IX = 1, NI
300             I = INT(IX)
301             IF( IVLARY(I,1) .LT. 0 )  GO TO 7098
302             NDD = IVLARY(I,1)+1
303             GO TO (7990,7001,7002,7003,7004,7005,7006,7007), NDD
304          7001 CONTINUE
305           C     EMP ONLY
306             WRITE(6,7109) I, IVLARY(I,1), ( DATA(I,L), L=2,3 )
307          7109 FORMAT( I7, I7, 3X, 15F7.2 )
308             GO TO 7100
309          7002 CONTINUE
310           C     TREE ONLY
311             WRITE(6,7109) I, IVLARY(I,1), ( DATA(I,L), L=4,6 )
312             GO TO 7100
313          7003 CONTINUE
314           C     EMP AND TREE
315             WRITE(6,7109) I, IVLARY(I,1), ( DATA(I,L), L=2,6 )
316             GO TO 7100
317          7004 CONTINUE
318           C     BLAST ONLY
319             WRITE(6,7109) I, IVLARY(I,1), ( DATA(I,L), L=7,9 )
320             GO TO 7100
321          7005 CONTINUE
322           C     EMP AND BLAST
323             WRITE(6,7109) I, IVLARY(I,1), ( DATA(I,L), L=2,3 ),
324            + ( DATA(I,L), L = 7,9 )
325             GO TO 7100
326          7006 CONTINUE
327           C     TREE AND BLAST
328             WRITE(6,7109) I, IVLARY(I,1), ( DATA(I,L), L=4,9 )
329             GO TO 7100
330          7007 CONTINUE
331           C     EMP, TREE, AND BLAST
332             WRITE(6,7109) I, IVLARY(I,1), ( DATA(I,L), L=2,9 )
333             GO TO 7100
334          7990 CONTINUE
335           C     PERSONNEL
336             WRITE(6,7999) I, IVLARY(I,1)
337          7999 FORMAT( 2I7 )
338             GO TO 7100
339          7098 WRITE(6,7899)  I
340          7899 FORMAT(' NO DATA FOR ITEM ', I6 )
341          7100 CONTINUE
```

```
342             GO TO ( 90, 5020 ), NBACK
343         9000 STOP
344             . END
```

```
AMUCK*KCCFILE(1).MACSET
      1              SUBROUTINE MACSET
      2        C     THIS ROUTINE SETS MACHINE DEPENDENT CONSTANTS
      3              COMMON/MACHIN/ ISIZE, MSIZE, MNAM
      4        C     ISIZE IS NUMBER OF CHARACTERS PER WORD
      5              ISIZE = 6
      6        C     MSIZE IS MAX WORDS ALLOWED FOR A NUMBER
      7              MSIZE = 3
      8        C     MNAM IS MAX WORDS ALLOWED FOR A NAME
      9              MNAM = 2
     10              RETURN
     11              END
```

```
AMUCK*RCCFILE(1).READ1
      1              SUBROUTINE READ1(IUN,$,$,$)
      2        C     THIS ROUTINE READS A CARD, CHECKS FOR $, END, OR EOF, AND CALLS RD1
      3              COMMON/CRD80 / IR(80)
      4              DATA IDOLL,IE,IN,ID,IB / 1H$, 1HE, 1HN, 1HD, 1H  /
      5              LOGICAL LDOLL
      6              LDOLL = .FALSE.
      7              READ(IUN,9,END=300) IR
      8           9  FORMAT( 80A1 )
      9              IF( IR(1).EQ.IE .AND. IR(2).EQ.N .AND. IR(3).EQ.ID .AND.
     10             $ IR(4).EQ.IB .AND. IR(5).EQ.IB )  RETURN3
     11              IF( IR(1) .EQ. IDOLL )  LDOLL = .TRUE.
     12              CALL RD1
     13              IF(LDOLL) RETURN2
     14              RETURN
     15          300 RETURN4
     16              END
```

```
AMUCK*RCCFILE(1).RD1
      1              SUBROUTINE RD1
      2        C     THIS ROUTINE READS A NAME, THEN A STRING OF NUMBERS
      3        C     NO. OF INTEGERS PUT IN NI, AND VALUES IN IN
      4        C     REALS IN NR, AND RR
      5        C     THE NAME GOES IN IWORD. NOTE: DIMENSION OF IWORD MUST BE MNAM - SET IN MACSET
      6              COMMON/MACHIN/ ISIZE, MSIZE, MNAM
      7              COMMON/ CARD / NAME(2), NR, RR(17), NI, INT(20)
      8              COMMON IS(80), IWORK(5)
      9              COMMON/CRD80 / IR(80)
     10              DATA IB,IC,ID,IE,IDOLL / 1H , 1H, , 1H., 1HE, 1H$ /
     11              LOGICAL LEXP, LREAL, LEAD, LONE
     12              NQUIT = MSIZE*ISIZE
     13              IF( IR(1) .NE. IDOLL )  GO TO 2
     14              I0 = 2
     15              IF( IR(2) .EQ. IC ) I0 = 3
     16              GO TO 22
     17         2    LEAD = .TRUE.
     18              LONE = .FALSE.
     19              N2 = ISIZE*MNAM
     20        C     LOOK FOR COMMA
     21              NC = 0
     22              DO 10  I = 1, 80
     23              N1 = I
     24              IF( IR(I) .EQ. IC )  GO TO 12
     25              IF( IR(I) .EQ. IB .AND. LEAD )  GO TO 10
     26              LEAD = .FALSE.
     27              NC = NC+1
     28              IF( NC .LE. N2 )  GO TO 8
     29              LONE = .TRUE.
     30              GO TO 20
     31         8    IS(NC) = IR(I)
     32        10    CONTINUE
     33        12    CONTINUE
     34        C     COMMA FOUND  LEFT JUSTIFY NAME, AND BLANK FILL TO RIGHT
     35              IF( N2-NC )  20,20,15
     36        15    NC1 = NC+1
     37              DO 16  I = NC1,N2
     38        16    IS(I) = IB
     39        20    ENCODE(N2,9,NAME) ( IS(I), I=1,N2 )
     40         9    FORMAT( 80A1 )
     41              IF(LONE)  GO TO 7744
     42              I0 = N1+1
     43        22    NL = 0
     44              NC = 0
     45              NI = 0
     46              NR = 0
     47              LEXP = .FALSE.
     48              LREAL = .FALSE.
     49              LEAD = .TRUE.
     50              DO  100  I = I0, 80
     51              IF( IR(I) .EQ. IB .OR. IR(I) .EQ. IC )  GO TO 50
     52              IF( IR(I) .EQ. ID )  LREAL = .TRUE.
     53              IF( IR(I) .EQ. IE )  LEXP = .TRUE.
     54              IF( LEAD )  N0 = I
     55              LEAD = .FALSE.
     56              NC = NC+1
```

```
57              GO TO 100
58           50 CONTINUE
59            C A BLANK/COMMA WAS READ.  IF LEADING, IGNORE
60              IF( LEAD )  GO TO 98
61            C NOT LEADING.  IT ENDS THE CURRENT NUMBER
62            C NOW WANT TO RIGHT JUSTIFY CHARACTERS IN MSIZE WORDS
63              NWD = ( NC-1 )/ISIZE + 1
64              IF( NWD .GT. MSIZE )  GO TO 7734
65              N2 = MSIZE*ISIZE-NC
66              IF( N2 .GT. 0 )  GO TO 58
67              N2 = 0
68              GO TO 65
69           58 DO 60  J = 1, N2
70           60 IS(J) = IB
71           65 IF( NC .EQ. 0 )  GO TO 72
72              N1 = N2+1
73              N2 = N2+NC
74              IX = 0
75              DO 70  J = N1, N2
76              IS(J) = IR( N0+IX )
77              IX = IX+1
78           70 CONTINUE
79           72 ENCODE(N2,9,IWORK) ( IS(J),J=1,N2 )
80            C THAT SQUNCHED THE NUMBER INTO COMPUTER WORDS.  NOW READ IT
81              IF( LREAL )  GO TO 75
82            C IT'S AN INTEGER
83              NI = NI+1
84              DECODE(N2,709,IWORK) INT(NI)
85           709 FORMAT( I18 )
86            C NOTE.  FIELD LENGTH IN ABOVE FORMAT = MSIZE*ISIZE
87              GO TO 95
88           75 NR = NR+1
89            C IT'S A REAL.  SEE IF IT'S AN EXPONENTIAL
90              IF( LEXP )  GO TO 78
91              DECODE(N2,759,IWORK)  RR(NR)
92           759 FORMAT( F18.0 )
93              GO TO 95
94           78 DECODE(N2,789,IWORK)  RR(NR)
95           789 FORMAT( E18.0 )
96           95 CONTINUE
97            C WE HAVE DECODED A NUMBER.  NOW CLEAR OUT FOR NEXT WORD
98              NL = 0
99              NC = 0
100             LEXP = .FALSE.
101             LREAL = .FALSE.
102             LEAD = .TRUE.
103             GO TO 100
104          98 CONTINUE
105           C MSIZE*ISIZE LEADING BLANKS/COMMAS INDICATES NO MORE DATA
106             NL = NL+1
107             IF( NL .GE. NQUIT )  GO TO 5000
108          100 CONTINUE
109          5000 CONTINUE
110             RETURN
111          7734 CONTINUE
112           C ERROR  NUMBER TOO LONG
113             WRITE(6,7799)
```

```
      7799 FORMAT(' NUMBER TOO LONG ON THIS CARD' )
           WRITE(6,7789) IR
      7789 FORMAT( 1X, 80A1 )
           STOP
      7744 CONTINUE
     C     DETECTED MORE THAN ONE NAME'S WORTH OF CHARACTERS WITHOUT A COMMA
     C     AFTER THE LEADING BLANKS ( IF ANY ).  ASSUME THAT THIS IS A ONE
     C     WORD CARD
           NR = 0
           NI = 0
           RETURN
           END
```

```
AMUCK*KCCFILE(1).READ0
      1              SUBROUTINE READ0(IUN,$,$,$)
      2        C     THIS ROUTINE READS A CARD OF NUMBERS
      3        C     NO. OF INTEGERS PUT IN NI, AND VALUES IN INT
      4        C     REALS IN NR, AND RR
      5        C     RETURN1 = $ ( CONTINUATION CARD ), RETURN2 = END CARD
      6        C     RETURN3 = @EOF, RETURN4 = NON-NUMERALICAL CHARACTER
      7              COMMON/MACHIN/ ISIZE, MSIZE, MNAM
      8              COMMON/ CARD / NAME(2), NR, RR(17), NI, INT(20)
      9              COMMON IS(80), IWORK(5)
     10              COMMON/CRD80 / IR(80)
     11              DATA IDOLL, IEND /1H$,1HE/
     12              DIMENSION IOK(16)
     13              DATA IOK / 1H0, 1H1, 1H2, 1H3, 1H4, 1H5, 1H6, 1H7, 1H8, 1H9,
     14             $ 1H , 1H,, 1H.,  1HE, 1H+, 1H- /
     15              LOGICAL LEXP, LREAL, LEAD, LDOLL
     16              NQUIT = MSIZE*ISIZE
     17              I1 = 1
     18              LDOLL = .FALSE.
     19              READ(IUN,9,END=6000) IR
     20              IF( IR(1) .NE. IDOLL )  GO TO 2
     21              LDOLL = .TRUE.
     22              I1 = 2
     23              IF( IR(2) .EQ. IOK(12) )  I1 = 3
     24         2    IF( IR(1) .EQ. IEND )  RETURN3
     25         9    FORMAT( 80A1 )
     26              NL = 0
     27              NC = 0
     28              NI = 0
     29              NR = 0
     30              LEXP = .FALSE.
     31              LREAL = .FALSE.
     32              LEAD = .TRUE.
     33              DO  100  I = I1, 80
     34              DO 10 J = 1, 16
     35        10    IF( IR(I) .EQ. IOK(J) )  GO TO 15
     36        C     IF HERE, IT'S A NON-NUMERICAL CHARACTER. STOP
     37              STOP
     38        15    CONTINUE
     39              IF( IR(I) .EQ. IOK(11) .OR. IR(I) .EQ. IOK(12) )  GO TO 50
     40              IF( IR(I) .EQ. IOK(13) )  LREAL = .TRUE.
     41              IF( IR(I) .EQ. IOK(14) )  LEXP = .TRUE.
     42              IF( LEAD )  NO = I
     43              LEAD = .FALSE.
     44              NC = NC+1
     45              GO TO 100
     46        50    CONTINUE
     47        C     A BLANK/COMMA WAS READ.  IF LEADING, IGNORE
     48              IF( LEAD )  GO TO 98
     49        C     NOT LEADING.  IT ENDS THE CURRENT NUMBER
     50        C     NOW WANT TO RIGHT JUSTIFY CHARACTERS IN MSIZE WORDS
     51              NWD = ( NC-1 )/ISIZE + 1
     52              IF( NWD .GT. MSIZE )  GO TO 7734
     53              N2 = MSIZE*ISIZE-NC
     54              IF( N2 .GT. 0 )  GO TO 58
     55              N2 = 0
     56              GO TO 65
```

```
      58    DO 60  J = 1, N2
      60    IS(J) = IOK(11)
      65    IF( NC .EQ. 0 )  GO TO 72
            N1 = N2+1
            N2 = N2+NC
            IX = 0
            DO 70  J = N1, N2
            IS(J) = IR( N0+IX )
            IX = IX+1
      70    CONTINUE
      72    ENCODE(N2,9,IWORK) ( IS(J),J=1,N2 )
C           THAT SQUNCHED THE NUMBER INTO COMPUTER WORDS. NOW READ IT
            IF( LREAL )  GO TO 75
C           IT'S AN INTEGER
            NI = NI+1
            DECODE(N2,709,IWORK) INT(NI)
      709   FORMAT( I18 )
C           NOTE.  FIELD LENGTH IN ABOVE FORMAT = MSIZE*ISIZE
            GO TO 95
      75    NR = NR+1
C           IT'S A REAL.  SEE IF IT'S AN EXPONENTIAL
            IF( LEXP )  GO TO 78
            DECODE(N2,759,IWORK)  RR(NR)
      759   FORMAT( F18.0 )
            GO TO 95
      78    DECODE(N2,789,IWORK)  RR(NR)
      789   FORMAT( E18.0 )
      95    CONTINUE
C           WE HAVE DECODED A NUMBER. NOW CLEAR OUT FOR NEXT WORD
            NL = 0
            NC = 0
            LEXP = .FALSE.
            LREAL = .FALSE.
            LEAD = .TRUE.
            GO TO 100
      98    CONTINUE
C           MSIZE*ISIZE LEADING BLANKS/COMMAS INDICATES NO MORE DATA
            NL = NL+1
            IF( NL .GE. NQUIT )  GO TO 5000
      100   CONTINUE
      5000  CONTINUE
            IF(LDOLL) RETURN2
            RETURN
      6000  RETURN4
      7734  CONTINUE
C           ERROR  NUMBER TOO LONG
            WRITE(6,7799)
      7799  FORMAT(' NUMBER TOO LONG ON THIS CARD' )
            WRITE(6,7789) IR
      7789  FORMAT( 1X, 80A1 )
            STOP
            END
```

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